Nucleonica Data Centre:

Nuclide Explorer

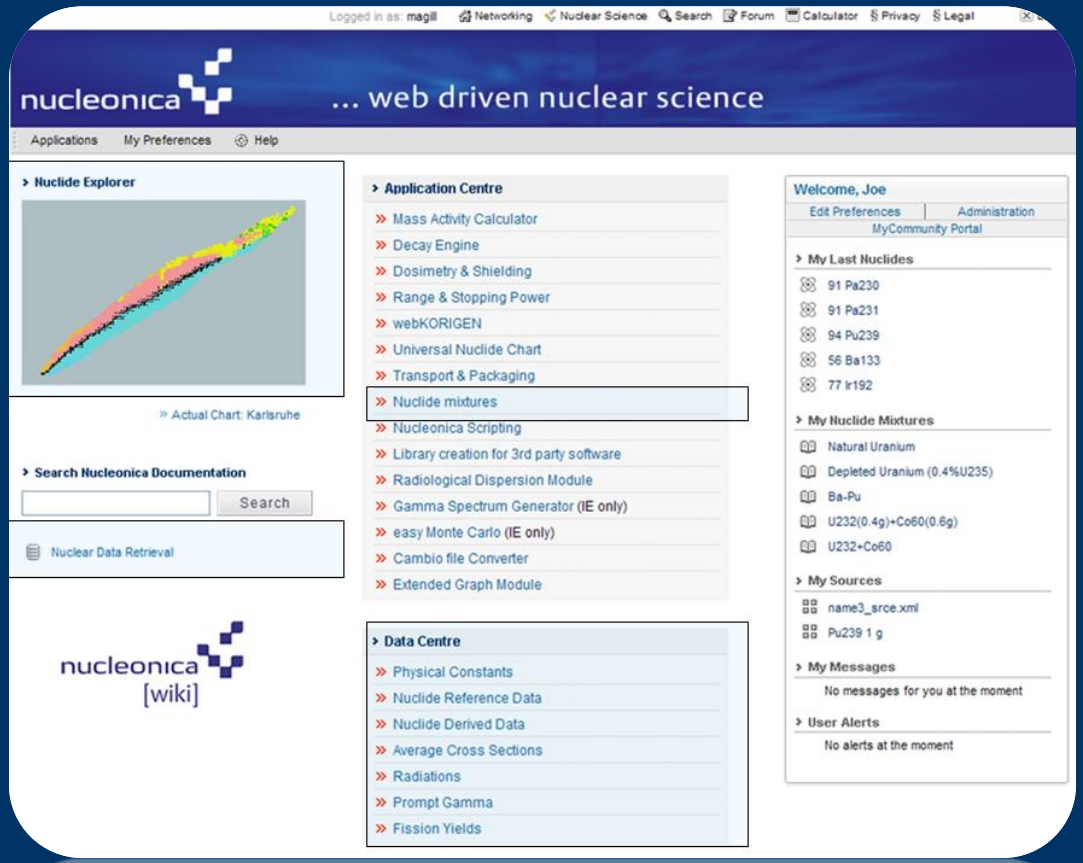
DataSheets

Nuclear Data Retrieval

Fission Yields

Universal Nuclide Chart

Karlsruhe Nuclide Chart



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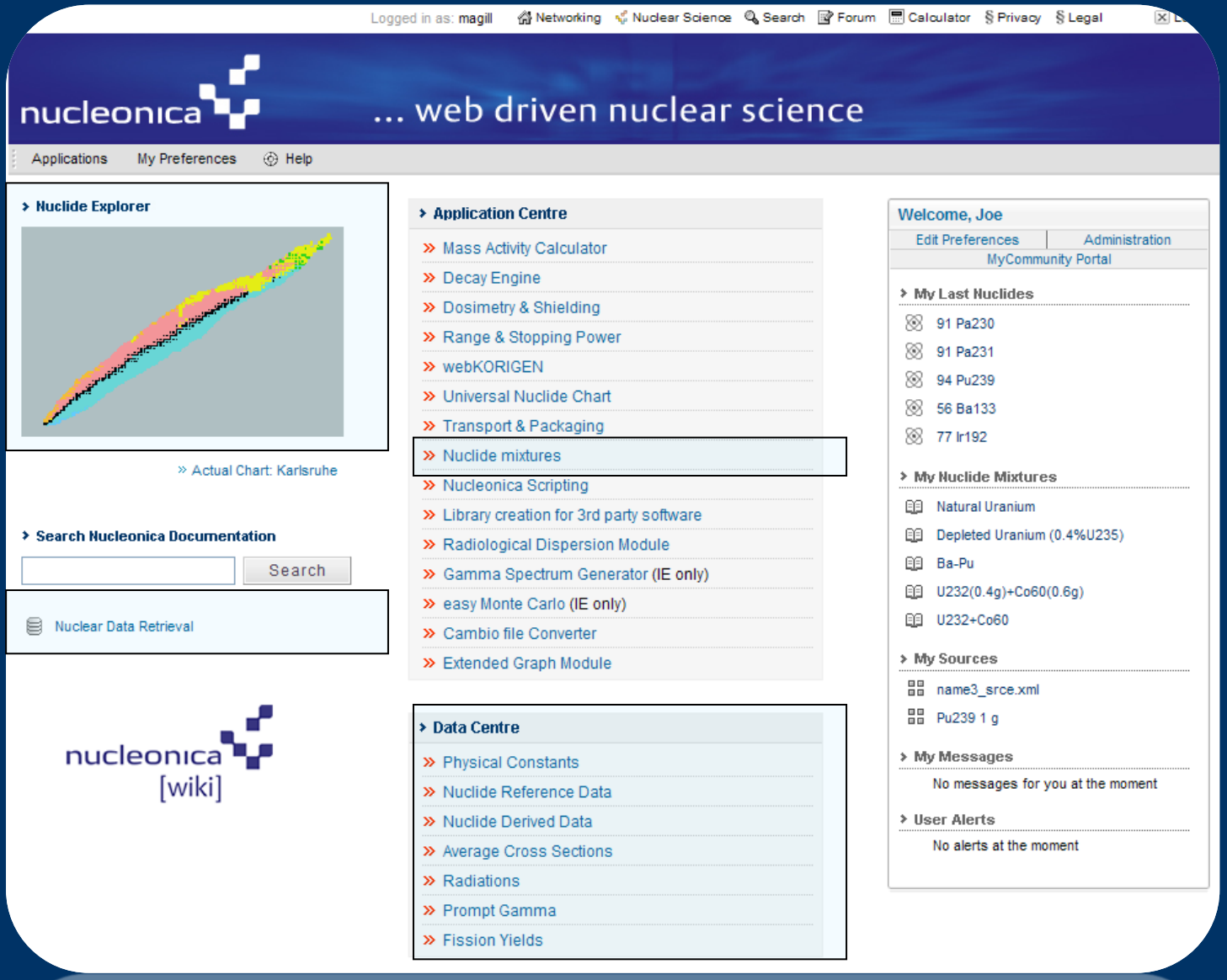
Where do we find nuclear data in Nucleonica?



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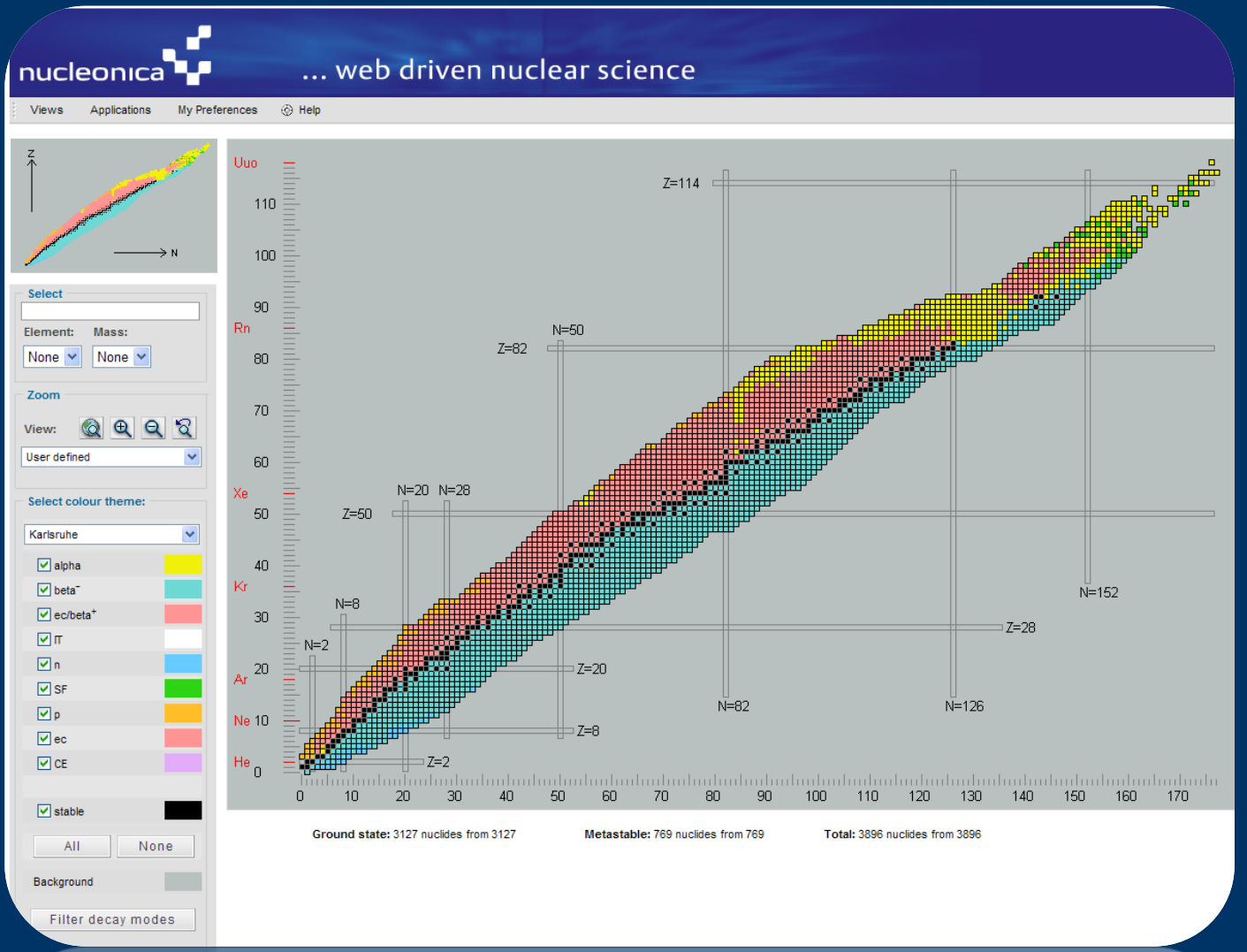
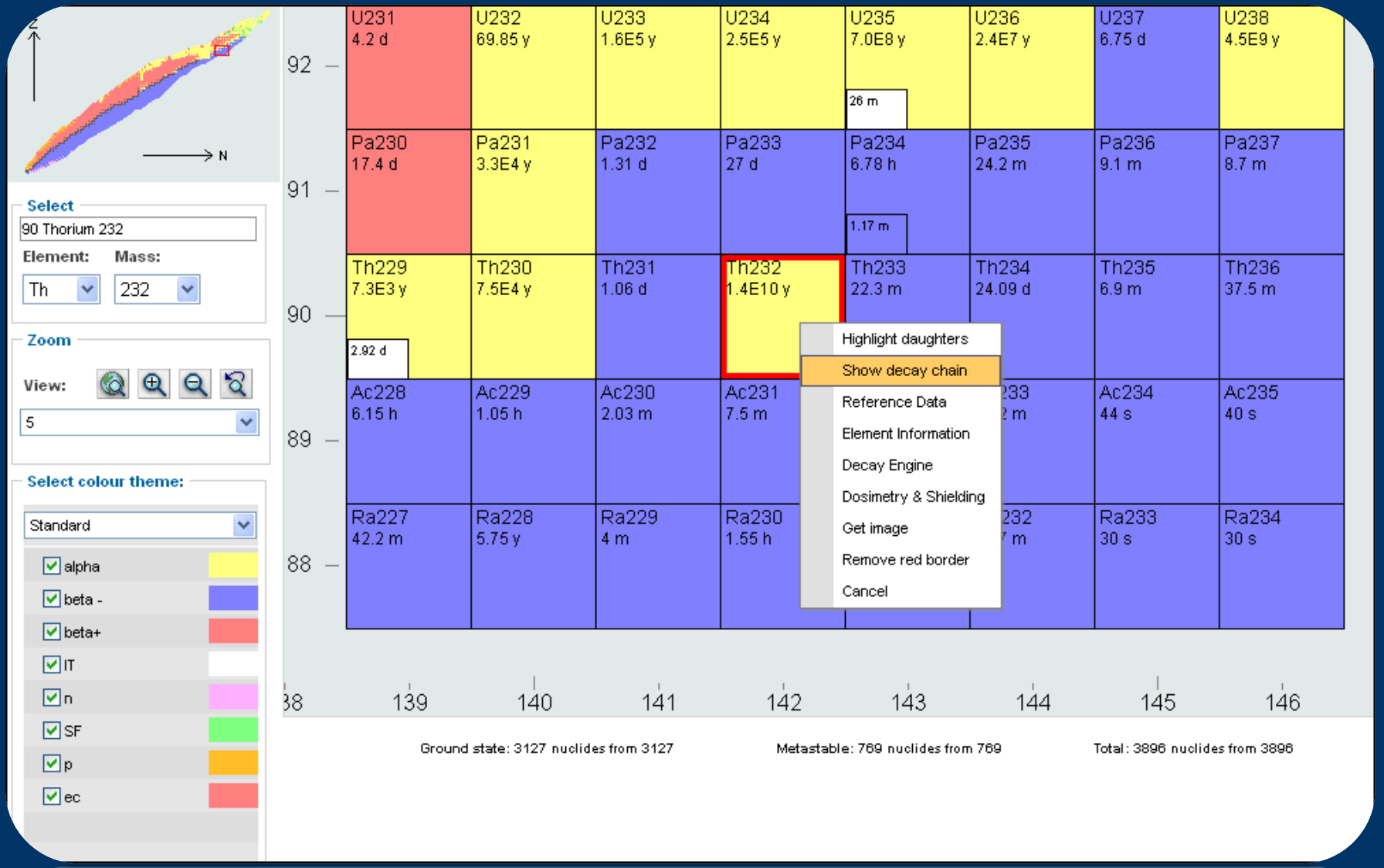
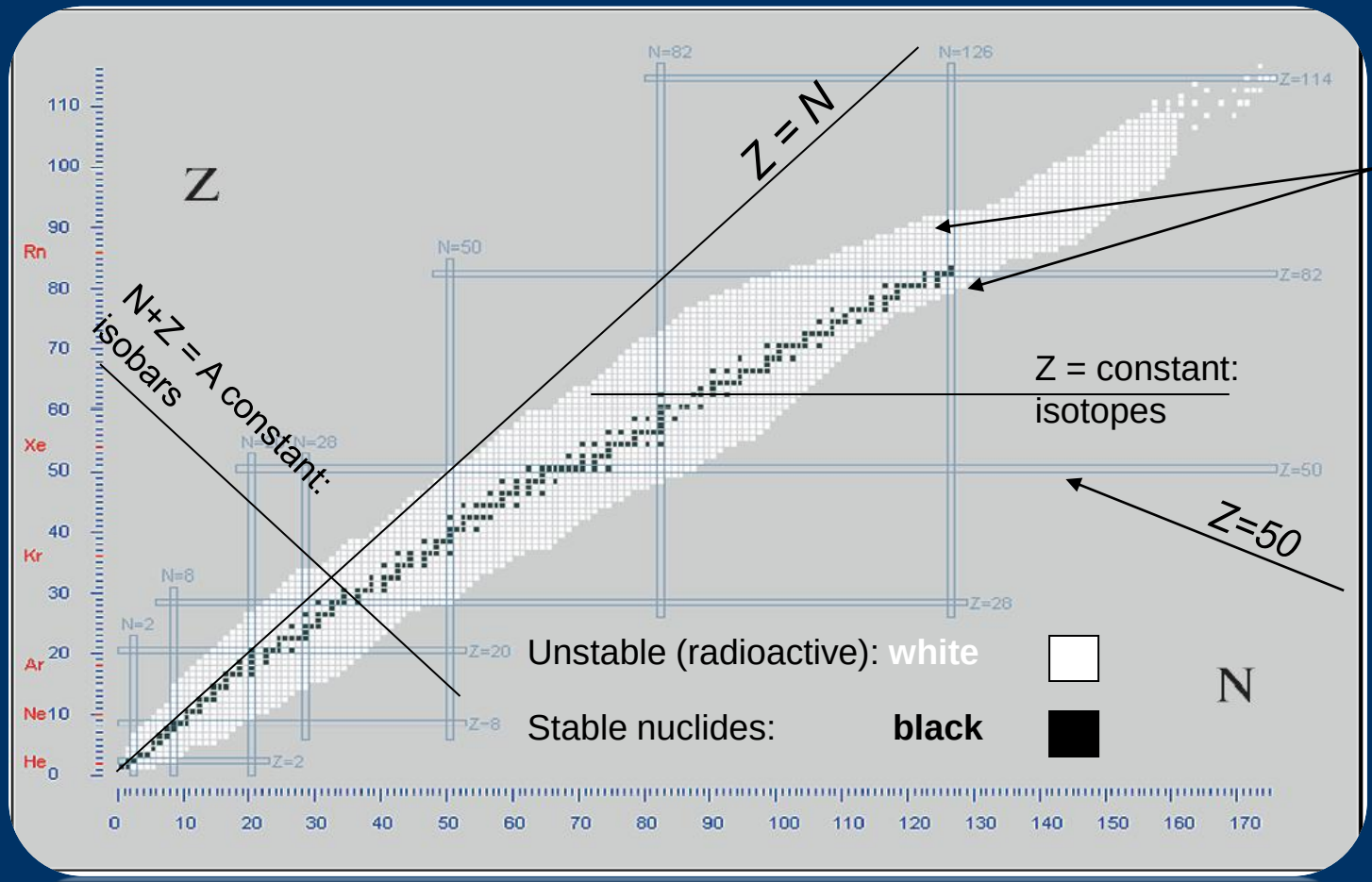
Nuclide Explorer…




Z
N
Select
90 Thorium 232
Element:
Mass:
Th
232
Zoom
View:
5
Select colour theme:
Standard
alpha
beta -
beta+
IT
n
SF
p
ec
92
91
90
89
88
U231 4.2 d
U232 69.85 y
U233 1.6E5 y
U234 2.5E5 y
U235 7.0E8 y
U236 2.4E7 y
U237 6.75 d
U238 4.5E9 y
26 m
Pa230 17.4 d
Pa231 3.3E4 y
Pa232 1.31 d
Pa233 27 d
Pa234 6.78 h
Pa235 24.2 m
Pa236 9.1 m
Pa237 8.7 m
1.17 m
Th229 7.3E3 y
Th230 7.5E4 y
Th231 1.06 d
Th232 1.4E10 y
Th233 22.3 m
Th234 24.09 d
Th235 6.9 m
Th236 37.5 m
2.92 d
Ac228 6.15 h
Ac229 1.05 h
Ac230 2.03 m
Ac231 7.5 m
Ac234 44 s
Ac235 40 s
Ra227 42.2 m
Ra228 5.75 y
Ra229 4 m
Ra230 1.55 h
Ra233 30 s
Ra234 30 s
Highlight daughters
Show decay chain
Reference Data
Element Information
Decay Engine
Dosimetry & Shielding
Get image
Remove red border
Cancel
138
139
140
141
142
143
144
145
146
Ground state: 3127 nuclides from 3127
Metastable: 769 nuclides from 769
Total: 3896 nuclides from 3896

What is a Nuclide Chart?

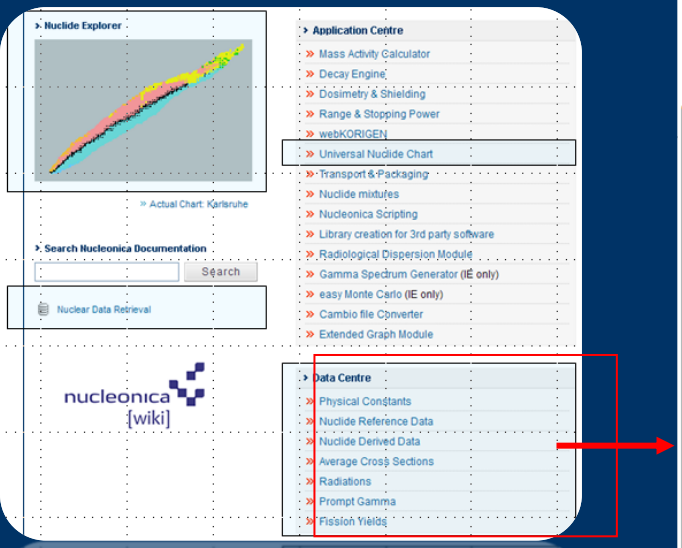


Extremities of the white regions are known as the proton and neutron drip-lines

Nuclei with even numbers of protons and neutrons are more stable. The stability is extremely significant for special numbers of protons and neutrons i.e. 2, 8, 20, 28, 50, 82,and 126. These are the **magic numbers**

For light nuclei, N = Z, but with increasing Z, N > Z, i.e. the number of neutrons increases more strongly than the number of protons. Note that the stable isotopes lie within a relatively narrow range indicationg that the neutron to proton ratio must have a certain value or range to be stable

Physical Constants…



Physical Constants

Physical Constants | Conversion Factors | Prefixes / Greek Alphabet | Radiological Limits

Physical Constants

Create new constant

Quantity	Symbol	Numerical Value	Uncertainty	Unit	Name In Script	
Speed of light in vacuum	c	299792458	0	ms^{-1}	Const_c	Edit
Newtonian constant of gravitation	G	6.67428E-11	67	$m^3kg^{-1}s^{-2}$	Const_G	Edit
Magnetic constant	μ_0	1.2566370614E-06	0	N/A^2	Const_mu0	Edit
Electric constant	ε_0	8.854187817E-12	0	Fm^{-1}	Const_eps0	Edit
Planck constant	h	6.62606896E-34	33	Js	Const_planck	Edit
reduced Planck constant	$\hbar$	1.054571628E-34	53	Js	Const_planck_2pi	Edit
Atomic mass constant	u	1.660538782E-27	83	kg	Const_u	Edit
Energy equivalent of atomic mass constant	u	931.494028	23	MeV	Const_u_energy	Edit
Neutron mass	m_n	1.674927211E-27	84	kg	Const_mn	Edit

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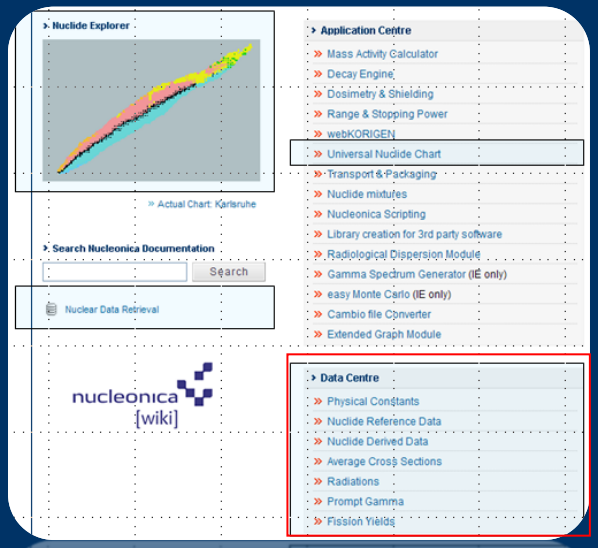
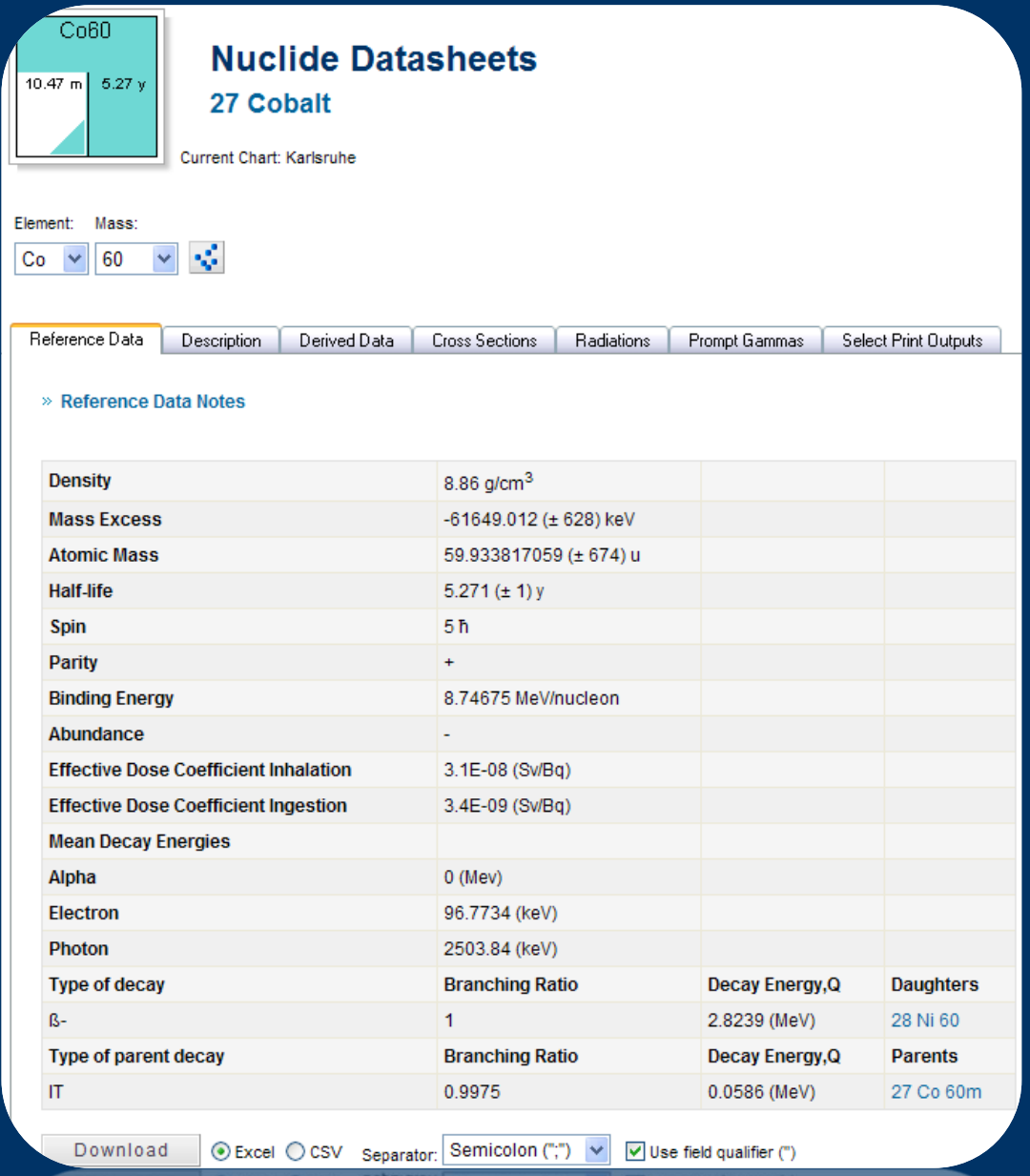
DataSheets…





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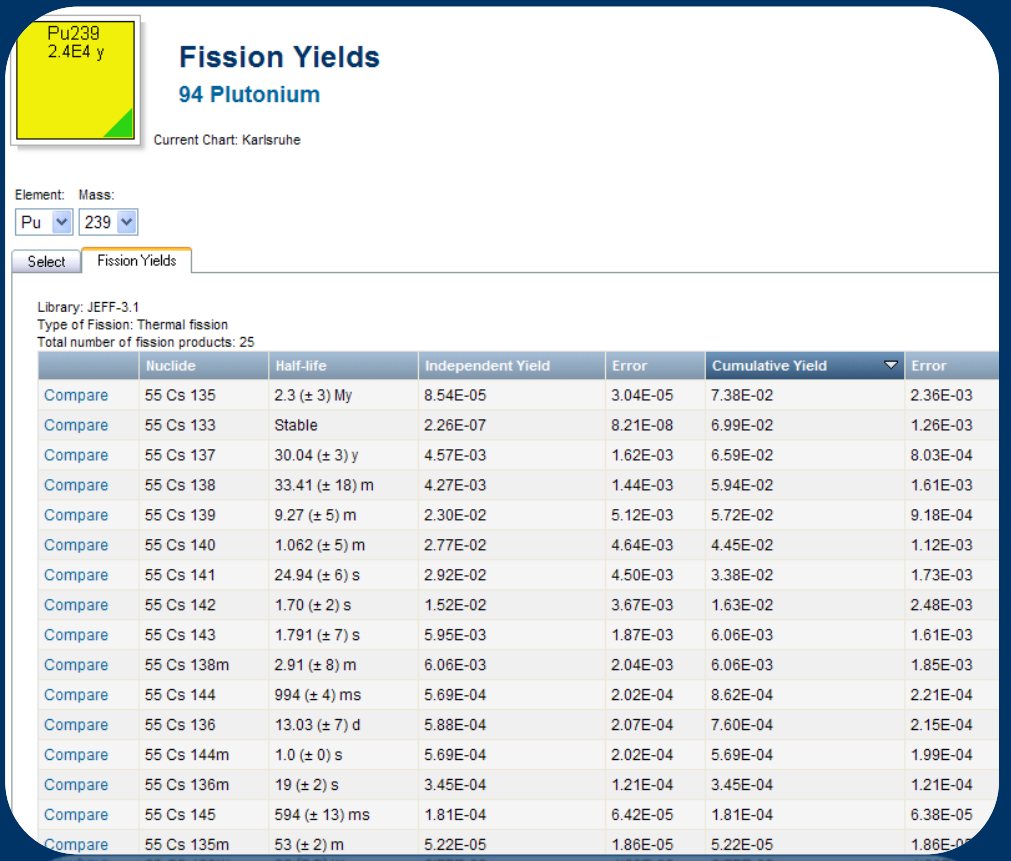
Fission Yields…



	Nuclide	Half-life	Independent Yield	Error	Cumulative Yield	Error
Compare	55 Cs 135	2.3 (± 3) My	8.54E-05	3.04E-05	7.38E-02	2.36E-03
Compare	55 Cs 133	Stable	2.26E-07	8.21E-08	6.99E-02	1.26E-03
Compare	55 Cs 137	30.04 (± 3) y	4.57E-03	1.62E-03	6.59E-02	8.03E-04
Compare	55 Cs 138	33.41 (± 18) m	4.27E-03	1.44E-03	5.94E-02	1.61E-03
Compare	55 Cs 139	9.27 (± 5) m	2.30E-02	5.12E-03	5.72E-02	9.18E-04
Compare	55 Cs 140	1.062 (± 5) m	2.77E-02	4.64E-03	4.45E-02	1.12E-03
Compare	55 Cs 141	24.94 (± 6) s	2.92E-02	4.50E-03	3.38E-02	1.73E-03
Compare	55 Cs 142	1.70 (± 2) s	1.52E-02	3.67E-03	1.63E-02	2.48E-03
Compare	55 Cs 143	1.791 (± 7) s	5.95E-03	1.87E-03	6.06E-03	1.61E-03
Compare	55 Cs 138m	2.91 (± 8) m	6.06E-03	2.04E-03	6.06E-03	1.85E-03
Compare	55 Cs 144	994 (± 4) ms	5.69E-04	2.02E-04	8.62E-04	2.21E-04
Compare	55 Cs 136	13.03 (± 7) d	5.88E-04	2.07E-04	7.60E-04	2.15E-04
Compare	55 Cs 144m	1.0 (± 0) s	5.69E-04	2.02E-04	5.69E-04	1.99E-04
Compare	55 Cs 136m	19 (± 2) s	3.45E-04	1.21E-04	3.45E-04	1.21E-04
Compare	55 Cs 145	594 (± 13) ms	1.81E-04	6.42E-05	1.81E-04	6.38E-05
Compare	55 Cs 135m	53 (± 2) m	5.22E-05	1.86E-05	5.22E-05	1.86E-05

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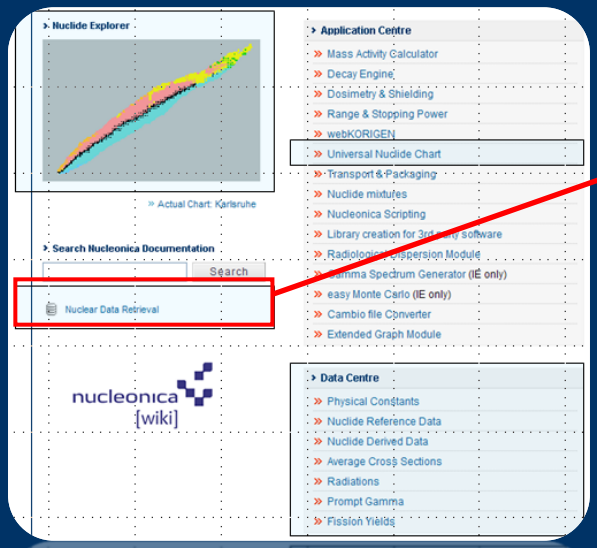
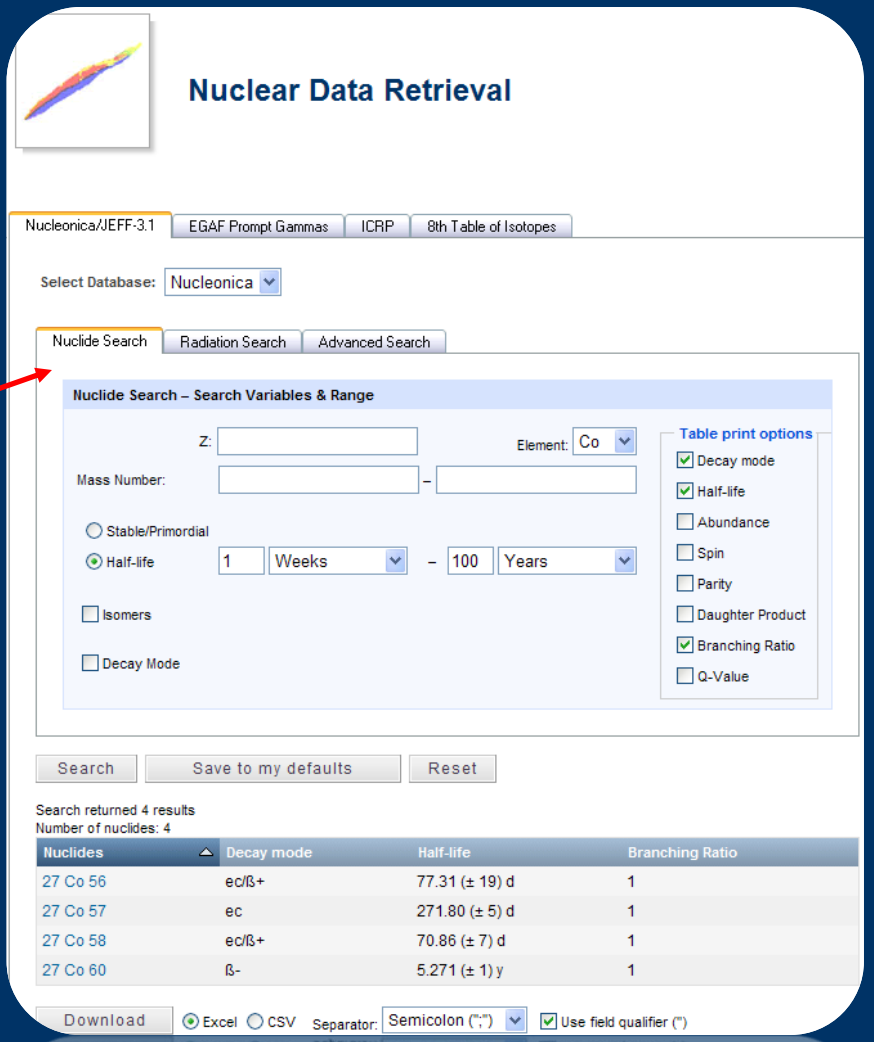
Nuclear Data Retrieval…





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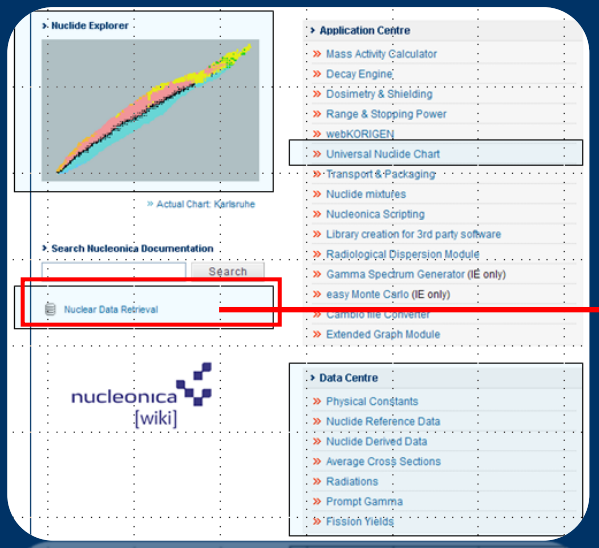
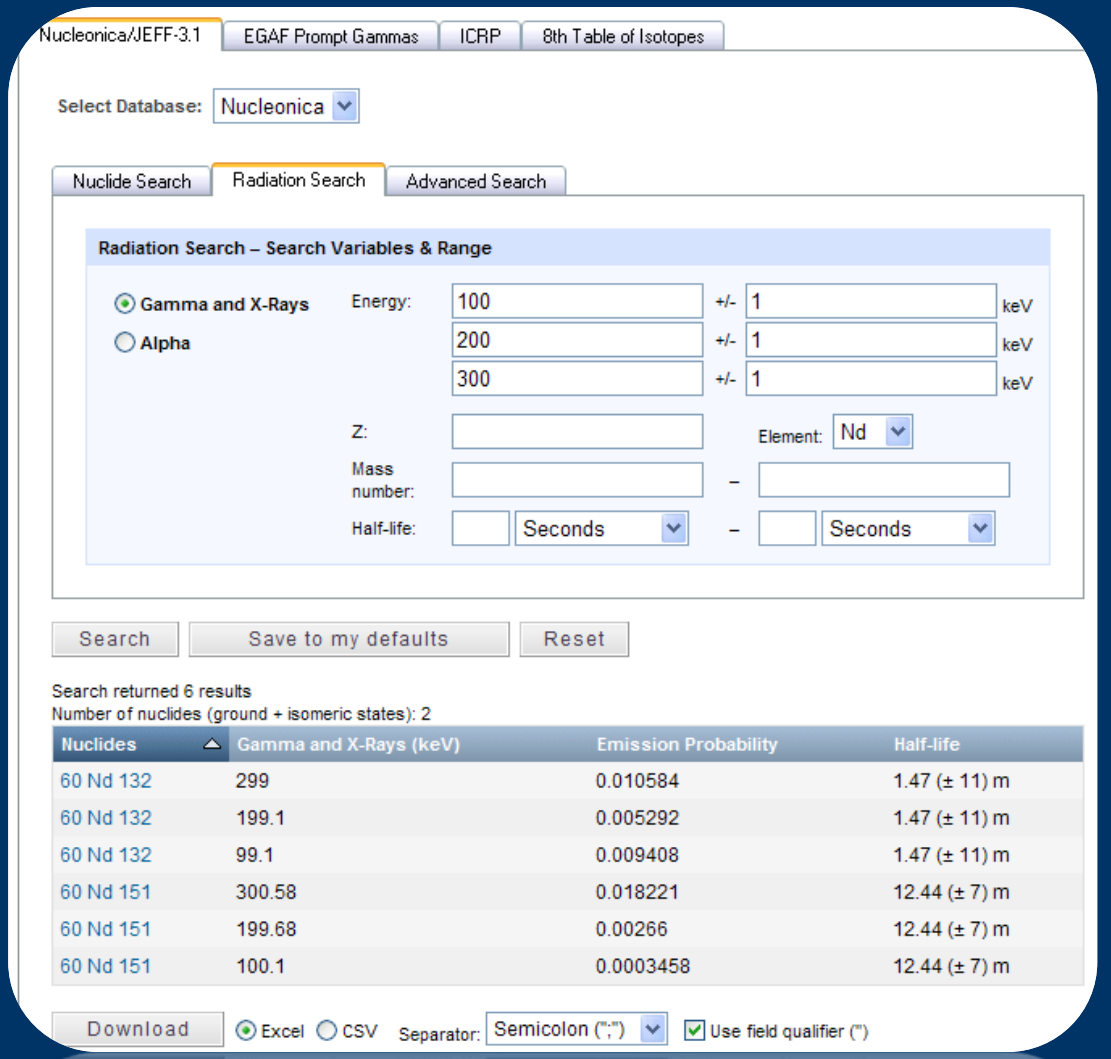
Nuclear Data Retrieval…





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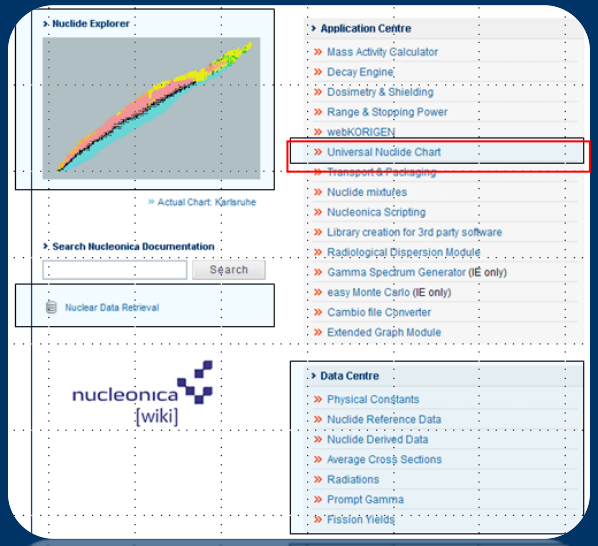
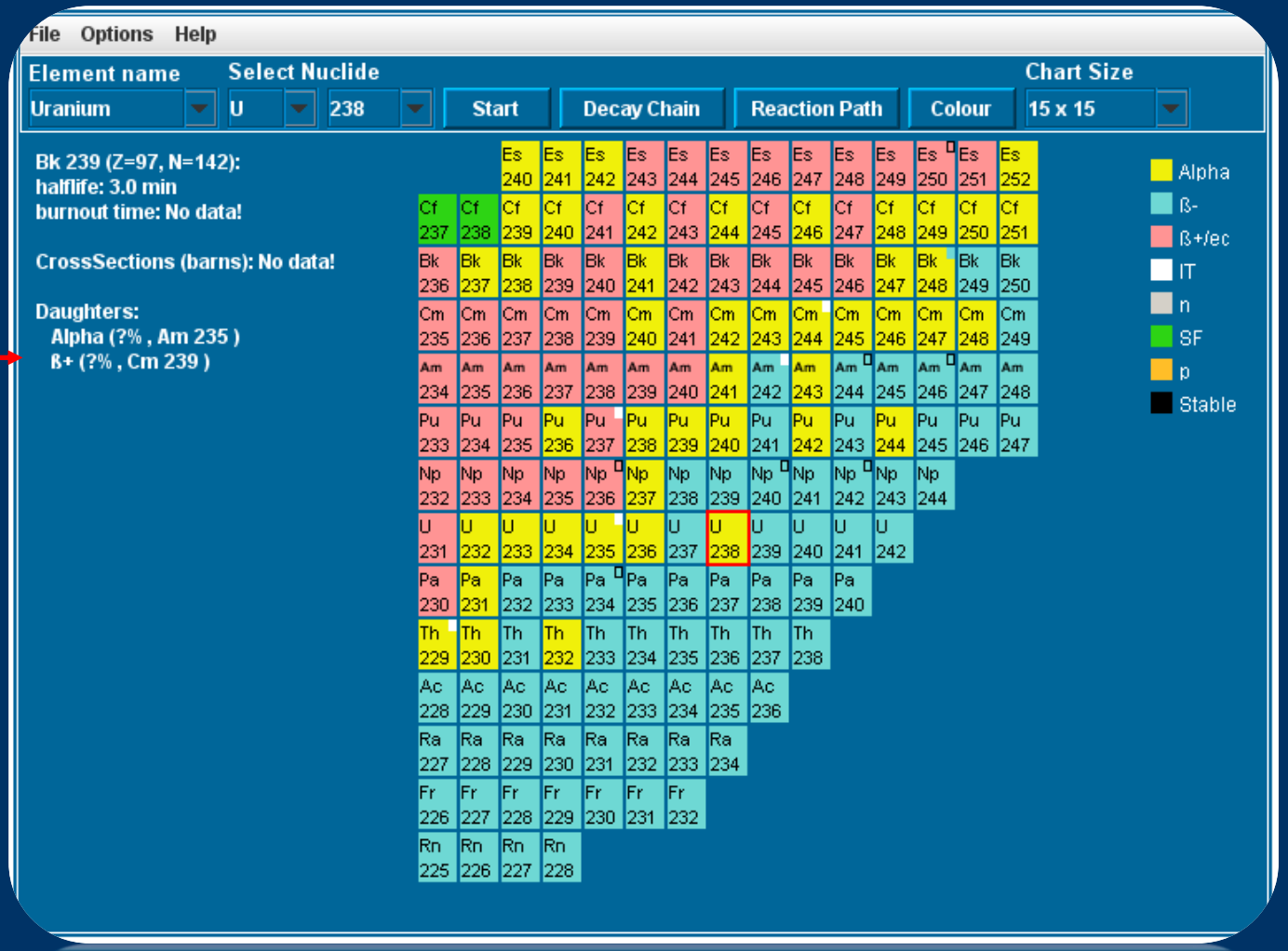
Universal Nuclide Chart...

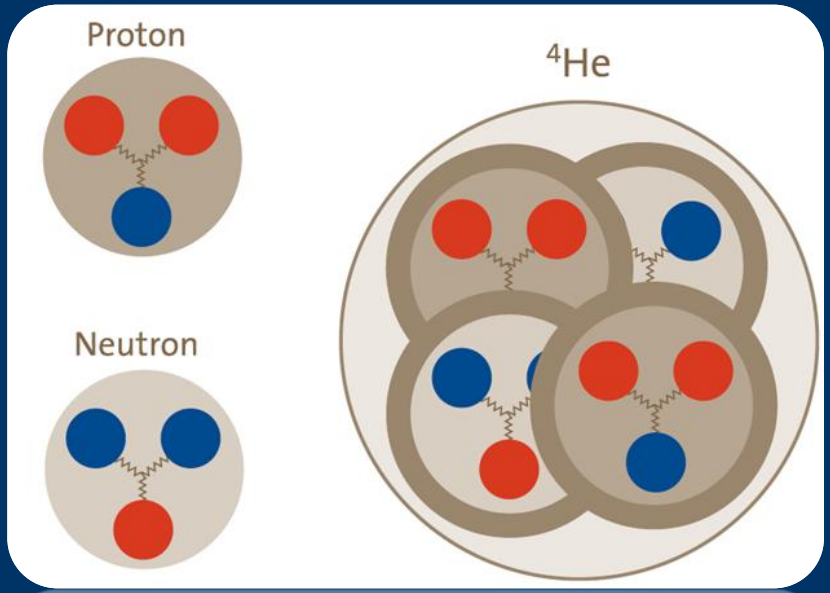




It all started with the Karlsruhe Nuclide Chart…

The Quark Structure of Nuclei

Quarks were proposed in independently by Gell-Mann and Zweig in 1964 as the basic building blocks of matter. The word "quark" was coined by Gell-Mann based on the sound made by ducks. Later, he discovered the use of the word quark in James Joyce's book Finnegan's Wake.

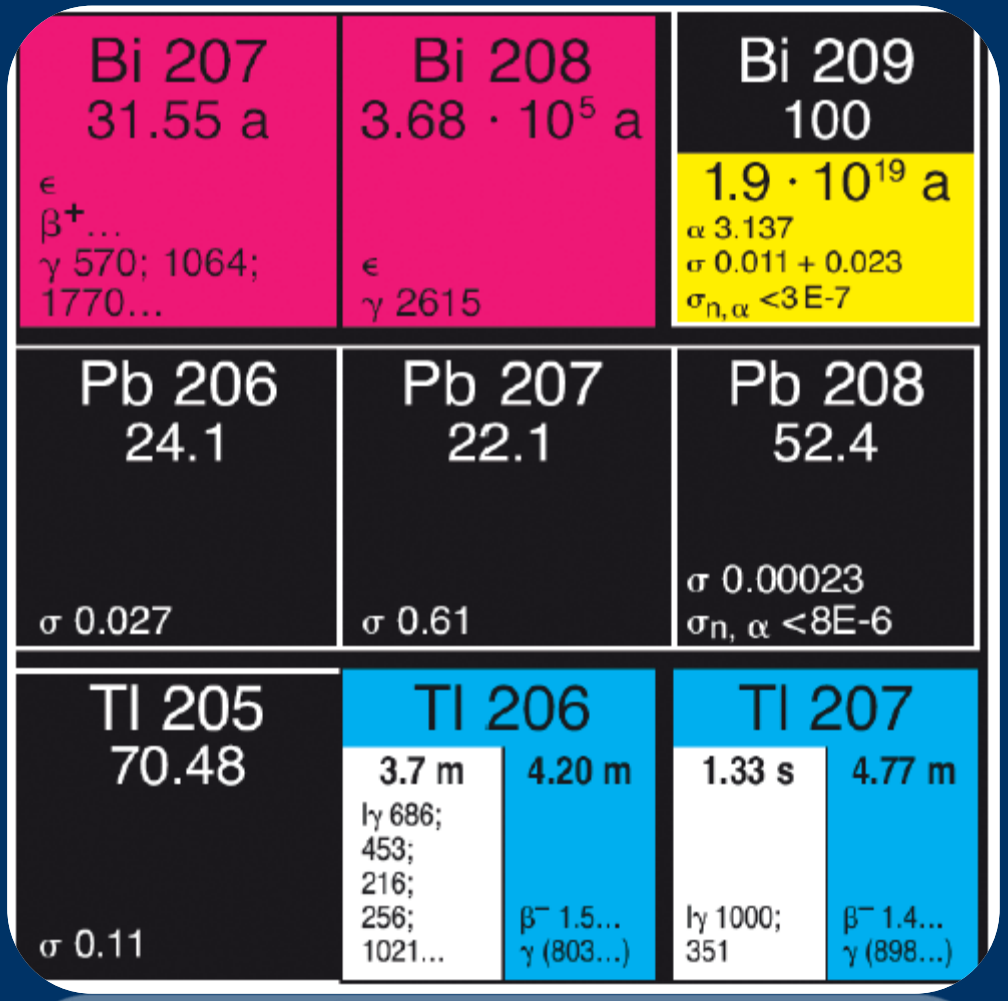


The quark structure of nucleons: the proton consists of two up quarks (red) and one down quark (blue) and the neutron one up and two down quarks held together by powerful gluon fields. (Right) the overlap of protons and neutrons in a helium-4 nucleus based on the static sizes of particles © American Physical Society, 2003.

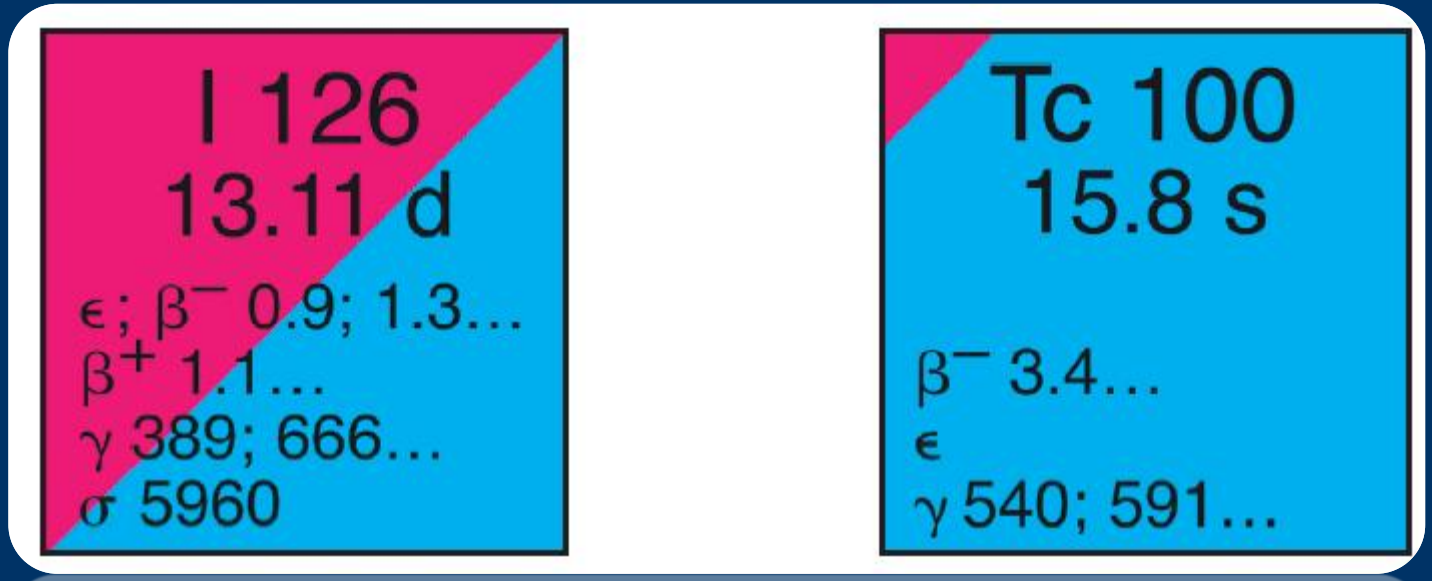
Use of colours in the Karlsruhe Nuclide Chart:

Already in the first Edition of the Karlsruhe Chart of the Nuclides, colours were used to indicate the decay modes

black = stable nuclide;
yellow = α-decay;
red = ß$^+$ decay or electron capture;
blue = ß$^-$ decay;
white = isomeric transition).



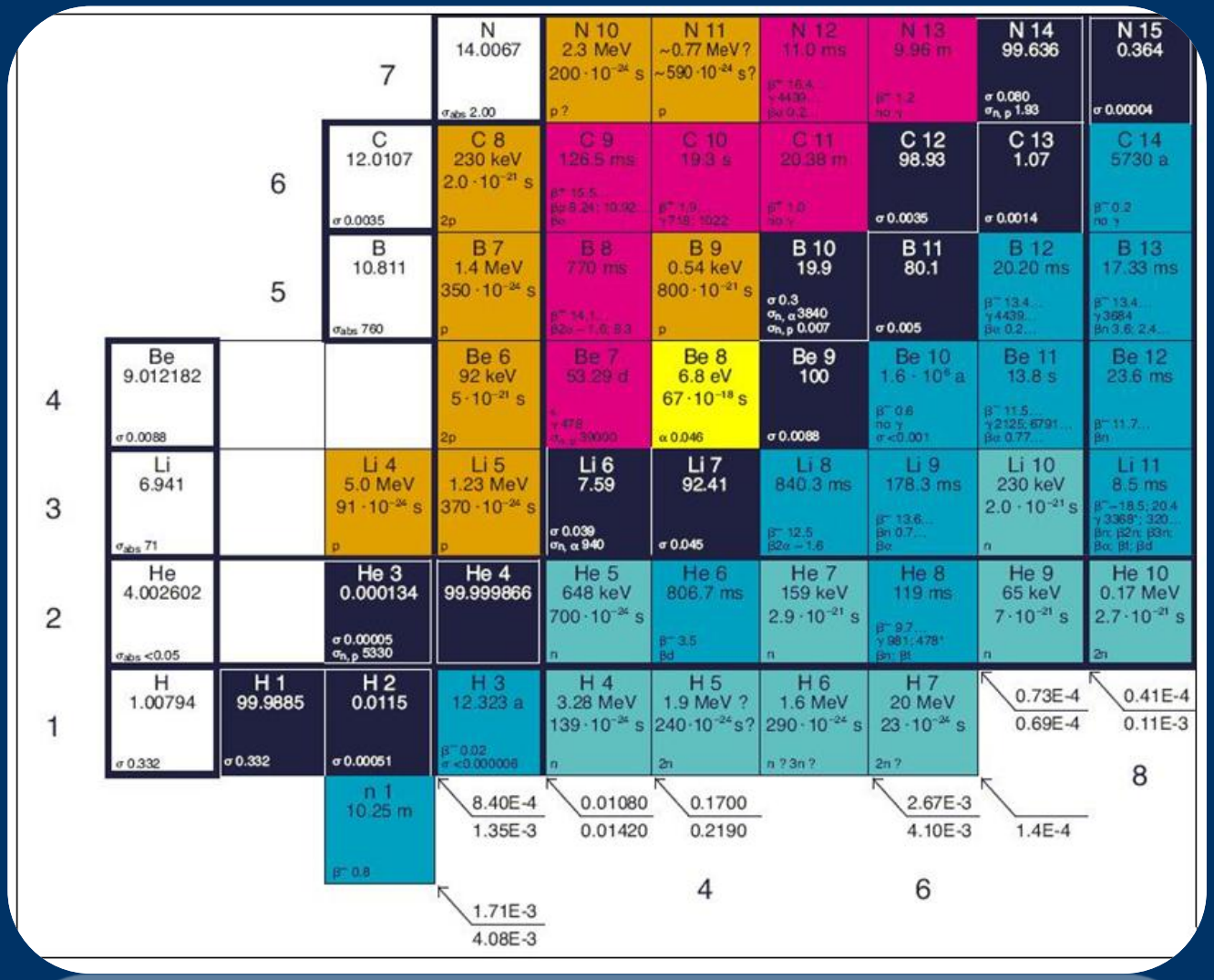
Branching ratios…



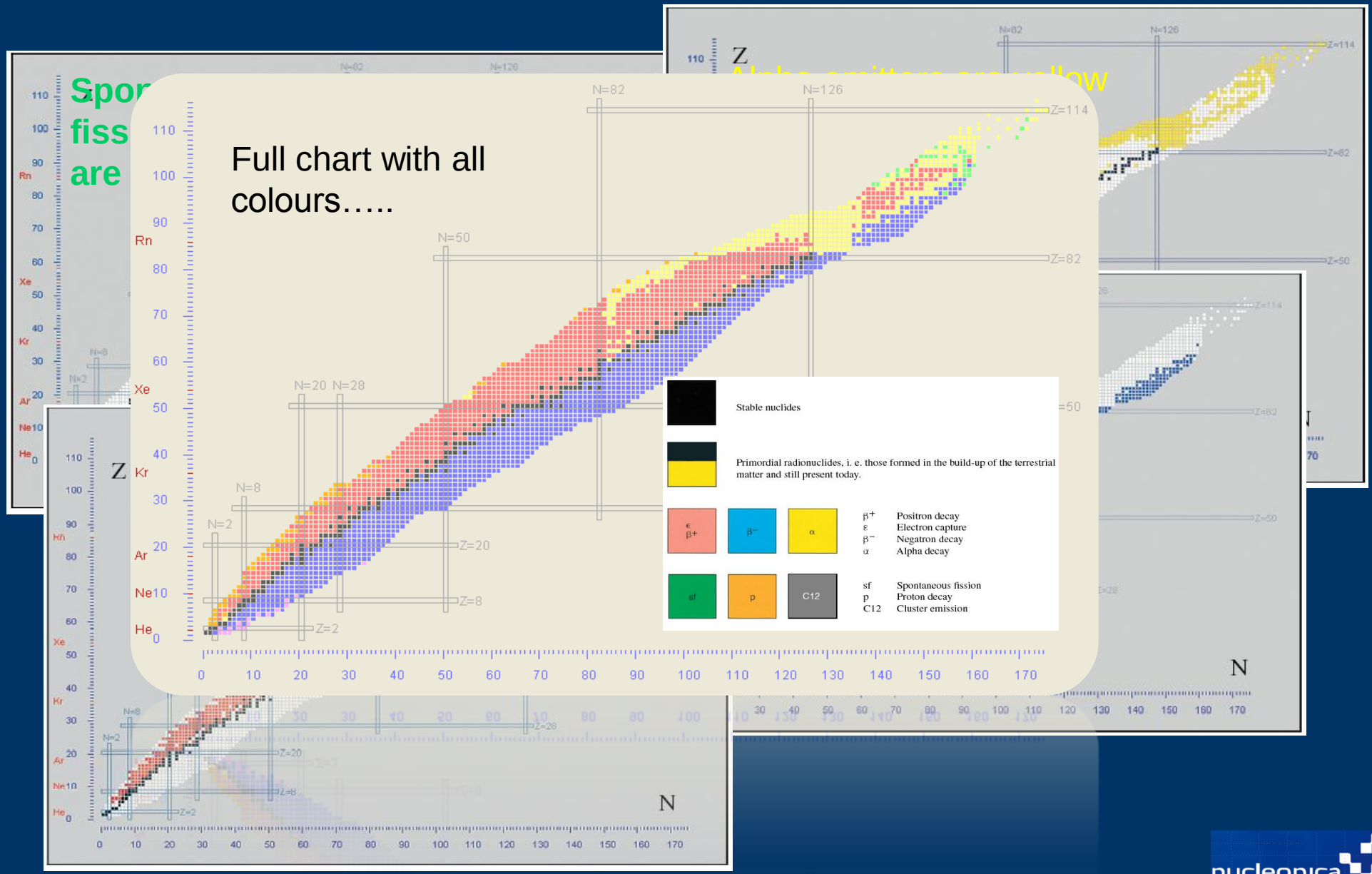
When a nuclide has more than one decay mode, coloured triangles give a rough indication of the branching ratios of each mode.
Left: The large triangles used in I-126, indicate the branching ratios for electron capture ε and ß⁻ emission are ≥ 5 %, but ≤ 95 % respectively.

Note that the decay modes are listed in the order of decreasing frequency.

Right: The small triangle used in Tc-100 indicates that the ε branching ratio is ≤ 5 %. The corresponding branching ratio for ß⁻ emission ≥ 95 %.


7
6
5
4
3
2
1
N 14.0067
N 10 2.3 MeV 200·10⁻²⁴ s
N 11 ~0.77 MeV? ~590·10⁻²⁴ s?
N 12 11.0 ms
N 13 9.96 m
N 14 99.636
N 15 0.364
C 12.0107
C 8 230 keV 2.0·10⁻²¹ s
C 9 126.5 ms
C 10 19.3 s
C 11 20.38 m
C 12 98.93
C 13 1.07
C 14 5730 a
B 10.811
B 7 1.4 MeV 350·10⁻²⁴ s
B 8 770 ms
B 9 0.54 keV 800·10⁻²¹ s
B 10 19.9
B 11 80.1
B 12 20.20 ms
B 13 17.33 ms
Be 9.012182
Be 6 92 keV 5·10⁻²¹ s
Be 7 53.29 d
Be 8 6.8 eV 67·10⁻¹⁸ s
Be 9 100
Be 10 1.6·10⁶ a
Be 11 13.8 s
Be 12 23.6 ms
Li 6.941
Li 4 5.0 MeV 91·10⁻²⁴ s
Li 5 1.23 MeV 370·10⁻²⁴ s
Li 6 7.59
Li 7 92.41
Li 8 840.3 ms
Li 9 178.3 ms
Li 10 230 keV 2.0·10⁻²¹ s
Li 11 8.5 ms
He 4.002602
He 3 0.000134
He 4 99.999866
He 5 648 keV 700·10⁻²⁴ s
He 6 806.7 ms
He 7 159 keV 2.9·10⁻²¹ s
He 8 119 ms
He 9 65 keV 7·10⁻²¹ s
He 10 0.17 MeV 2.7·10⁻²¹ s
H 1.00794
H 1 99.9885
H 2 0.0115
H 3 12.323 a
H 4 3.28 MeV 139·10⁻²⁴ s
H 5 1.9 MeV ? 240·10⁻²⁴ s?
H 6 1.6 MeV 290·10⁻²⁴ s
H 7 20 MeV 23·10⁻²⁴ s
n 1 10.25 m
8.40E-4
1.35E-3
0.01080
0.01420
0.1700
0.2190
2.67E-3
4.10E-3
1.4E-4
0.73E-4
0.69E-4
0.41E-4
0.11E-3
1.71E-3
4.08E-3
4
6
8

What the colours mean…



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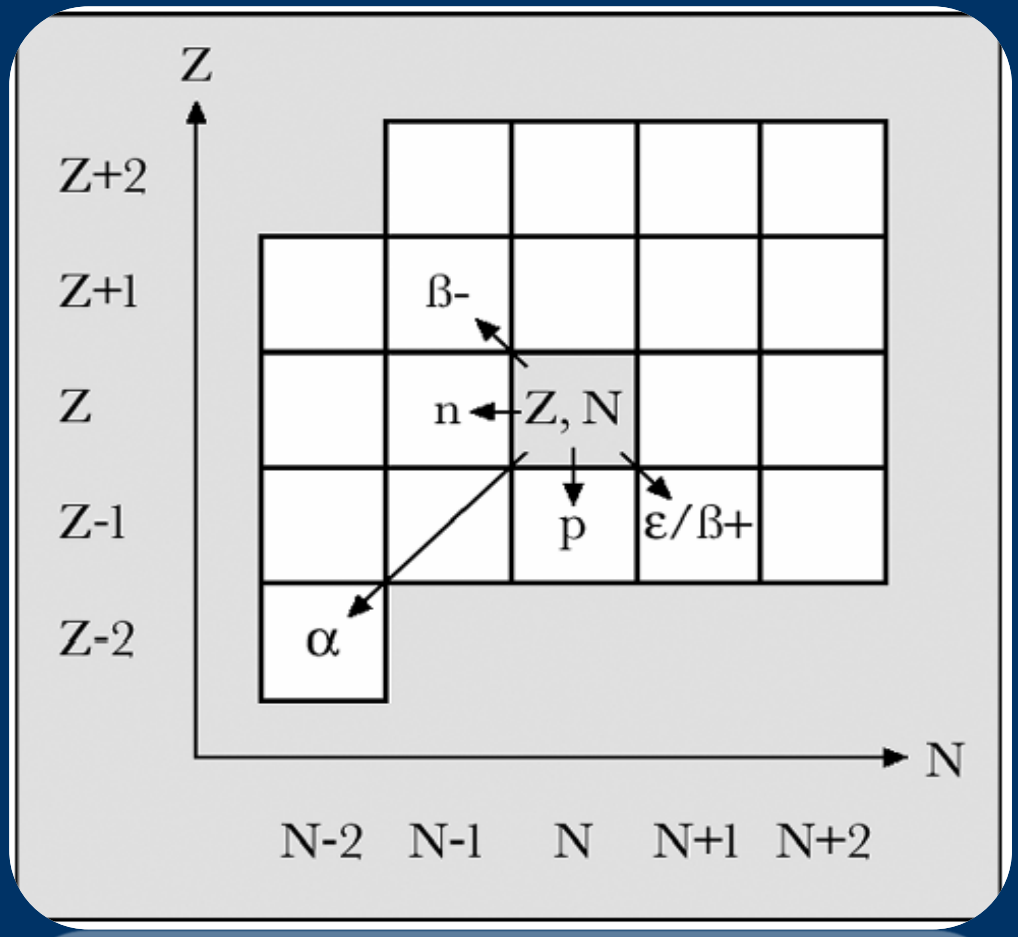
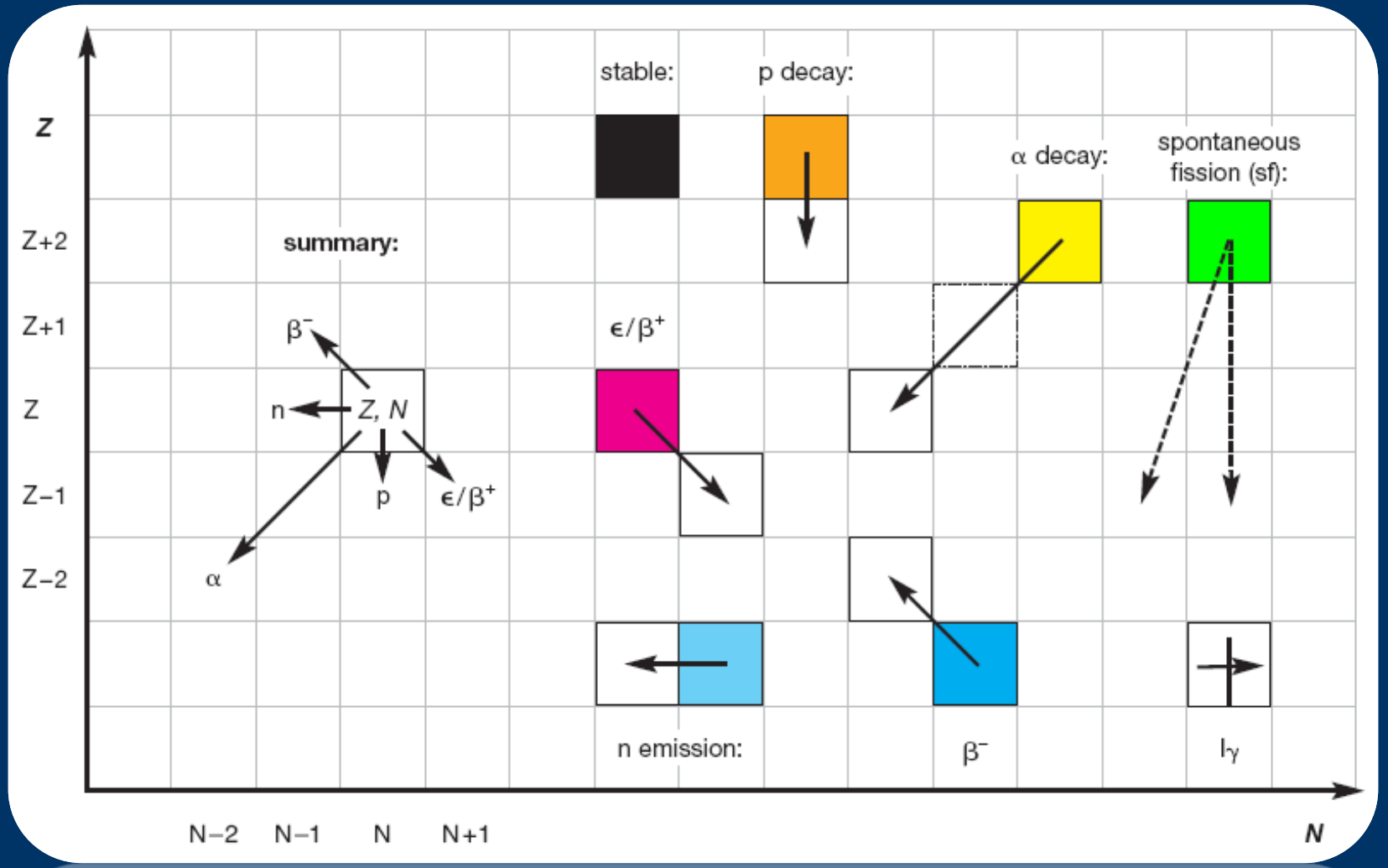
Radioactive Decay Processes

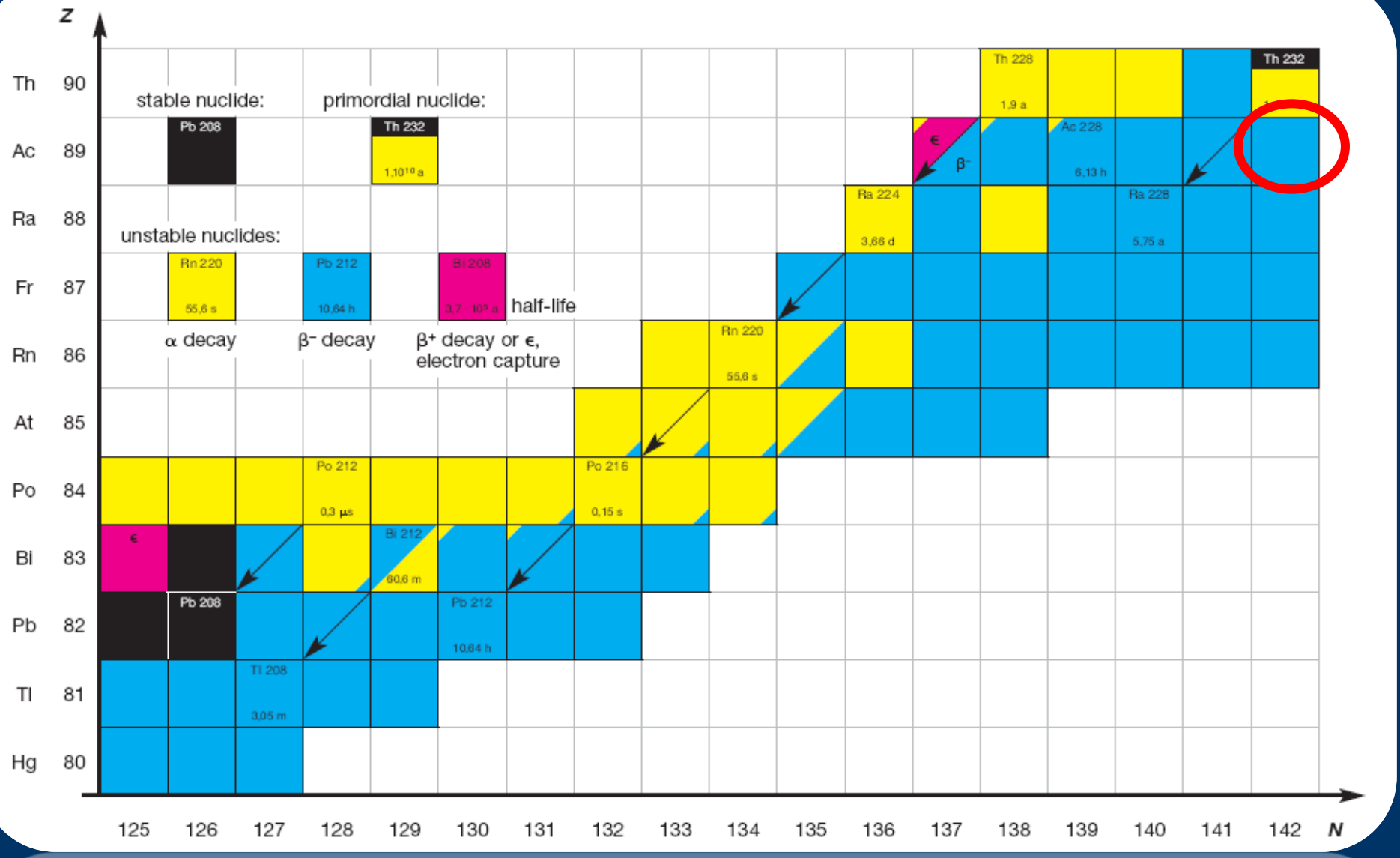
Nuclear decay processes on the nuclide chart. A nuclide with “co-ordinates” *Z,N* transforms to the nuclide *Z´,N´* through the decay processes shown



Radioactive Decay on the Nuclide Chart…



Karlsruher Nuklidkarte: Th232 decay chain



Thanks!

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